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ABSTRACT

Designed to measure skills involving latitude and longitude, this is a self-administering linear program for junior-high geography students. Students progress through 59 pages of fill-in-the-blank items, accompanied by appropriate line drawings, for which the correct answers are given below each question. Following the method of programmed learning, the student covers the printed answer until he completes the item himself. If his answer is wrong, he rereads the item until he understands the concept. Questions emphasize (1) use of the globe as an instrument for learning and understanding latitude and longitude, and (2) latitude and sun behavior through a complete revolution of the earth around the sun in a year of 364 1/4 days. Items involve knowledge of such things as parallels and degree location, orientation in terms of the Prime Meridian, time changes among zones, and angles of sun's rays throughout the seasons. (AV)

PROGRAMMED LATITUDE AND LONGITUDE

Special Publication Number 10

JEAN C. HOOVER

NATIONAL COUNCIL FOR GEOGRAPHIC EDUCATION

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NORMAL, ILLINOIS 61761

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INTRODUCTION

Programmed Latitude and Longitude evolved from classroom experiences. Mrs. Jean C. Hoover teaches seventh grade geography and science in the Penn Hills Public School System, Pittsburgh, Pennsylvania. For a number of years, she has been experimenting with methods and techniques that will improve the teaching of geography. Several years ago, Mrs. Hoover prepared some programs for helping students gain skills in the reading and use of maps. The results were rewarding and her students began asking for more programmed activities.

With this background, Mrs. Hoover structured, implemented, tested, and evaluated her original program during her graduate studies. *Programmed Latitude and Longitude* is a part of her master's thesis, with Professor Mamie L. Anderzohn as the advisor, at Indiana University of Pennsylvania.

Special appreciation is acknowledged to Mrs. Ann Linger, Art Teacher at Morgantown High School, Morgantown, West Virginia, for drawing all of the illustrations in *Programmed Latitude and Longitude*.

This is a linear, machineless program. It requires this booklet for each student, a sheet of paper the size of the page of this booklet, and a pencil. This program may be used at different levels, wherever a student needs help in the skills involving latitude and longitude. The student proceeds at his own pace. Read and follow the directions on the following page.

KERMIT M. LAIDIG
Director of Publications

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THE PROGRAMS

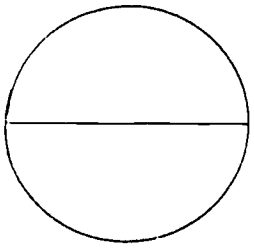
Directions: On the following pages are a series of statements and questions designed to test your knowledge of several skills in geography. They are presented in a manner called programmed learning. Before you begin to read the statements obtain a heavy sheet of paper which will be used to cover the succeeding statements as well as the answers. Now cover all the written material on the question sheet except the first statement. You are ready to begin. Read each statement carefully and then write your answer in the blank at the end of the statement. After completing your answer, move the cover sheet down far enough so you completely expose the second statement. You will note that the correct answer to the preceeding statement has been exposed in the left hand margin. If your answer is not correct, go back and re-read the statement to find why your answer is not correct. If you have answered the statement correctly, proceed in the same manner with the second statement. These work sheets are designed to develop your skill in the use of measurement and sets of relationships as you study geography.

The program, Measurement Skills, has been designed to develop the measurement skills in geography as they develop into sets of relationships. Emphasis has been placed on:

1. The use of the globe as an instrument for learning and understanding latitude and longitude.

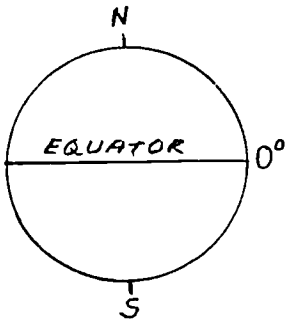
2. Latitude and sun behavior through a complete revolution of the earth around the sun in a year of 365¼ days.

MEASUREMENT SKILLS



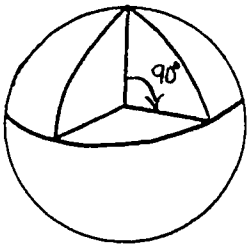
A model for the earth is the globe. The globe can be divided into halves. "Hemi" means half. One half of the globe is a hemisphere. We call half of the globe a _____.

hemisphere

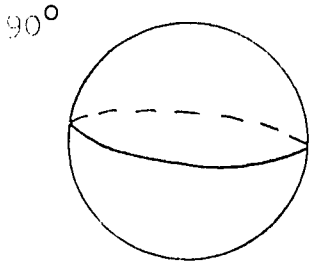


For purposes of location, the globe's surface is divided by lines. The line that is equally distant from the two poles and divides the globe into the northern and southern hemispheres is the equator. The line that divides the globe into the northern and southern hemispheres is the _____.

equator



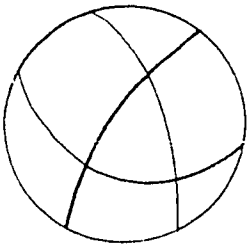
The equator is equally distant from the North and South Poles. The distance from the equator to the poles is measured in degrees, (°) The North Pole is 90° north of the equator, and 90° south of the equator is the South Pole. The number of degrees from the equator to the North Pole is _____.



A great circle is a term used to describe the largest circle that can be drawn on the surface of the globe. The largest circle that can be drawn on the earth is a _____ circle.

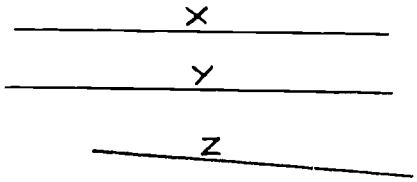
great

There are many great circles on the globe. They are always the largest circles that can be drawn on the globe. The great circle is the shortest distance between two places on the globe. The equator is an example of a great_____.



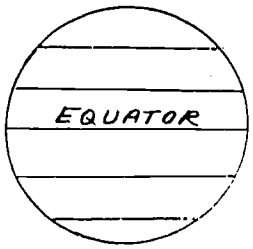
circle

Lines are parallel if they are drawn in the same direction and no matter how far they are extended they never meet. Lines X and _____ are parallel to each other.



Y

Lines drawn parallel to the equator are used to measure distance north and south of the equator. These lines are called latitude lines. _____lines are parallel to the equator and measure distance north and south of it.



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latitude

Since lines of latitude are parallel to the equator, they are also called parallels. Lines of latitude that measure distance from the equator are also called_____.

parallels

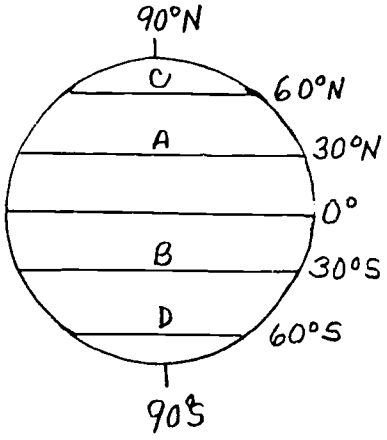
Latitude, or distance north and south of the equator, is measured in degrees. The symbol for degrees is °. Degrees of _____ are used to measure distance north and south of the equator.

latitude

In talking or writing about parallels or latitude, make certain that you indicate the direction you are traveling from the equator. The South Pole is 90°_____ (direction) latitude.

S or South

All parallels lie between 0° and 90°. The latitude of parallel A is 30°N and the latitude of parallel B is 30°S. The latitude of parallel C is _____°.



11

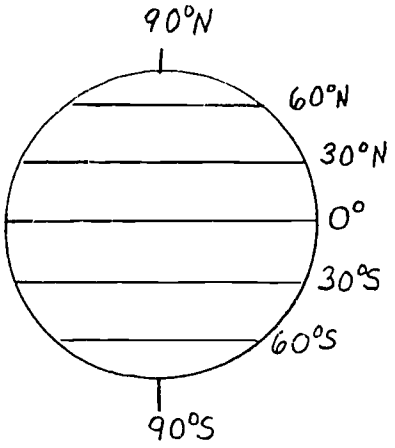
$60^{\circ}N$

The latitude of parallel D is _____ .

$60^{\circ}S$. Did you remember to put the symbol for degrees and the direction after the latitude?

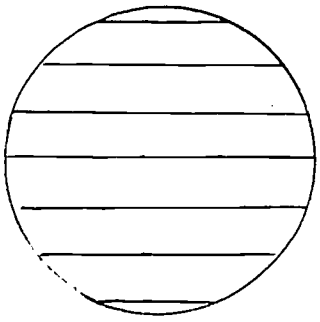
An important use of parallels is measuring the distance (north or south) a place is from the _____.

equator



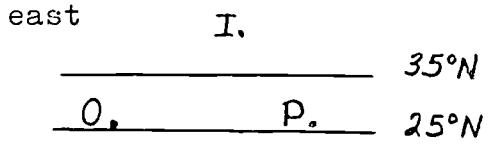
You can see on a map or globe that as you move north and south of the equator, the numbers become higher until you get to _____ .

90°

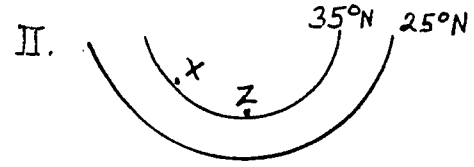


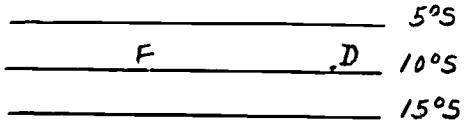
Regardless of how parallels are portrayed, they are East-West direction lines. Note that the parallels run east and west.

Parallels tell true direction. Every point on a parallel is directly_____or west of any other point on the parallel.



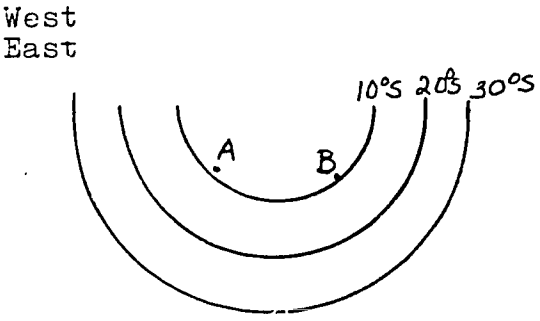
On some maps, the parallels may appear differently but true direction (east and west) is still true. In drawing I, O is west of P. In drawing II, X is west of Z.

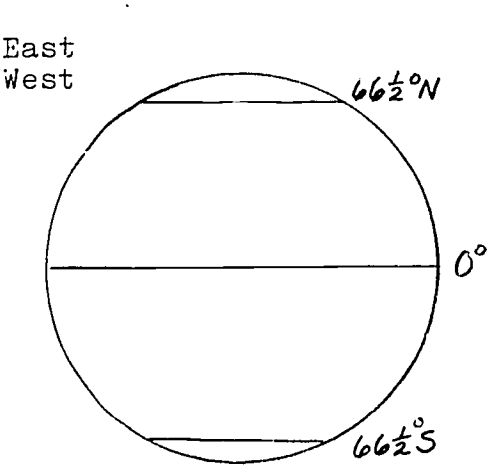




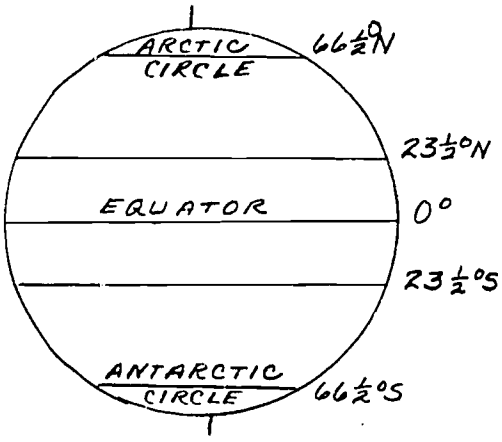
Let's try this. F is _____ of D (direction). D is _____ of F (direction).

B is _____ of A (direction)
A is _____ of B (direction)

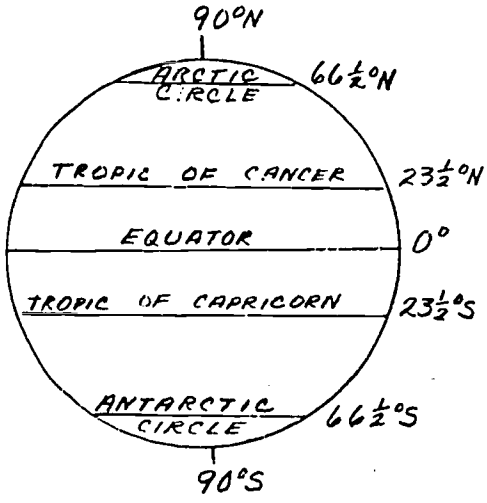




There are many parallels of latitude north and south of the equator. Some of these parallels have specific names. The $66\frac{1}{2}^{\circ}$N parallel is called the Arctic Circle. The $66\frac{1}{2}^{\circ}$S parallel is called the Antarctic Circle.

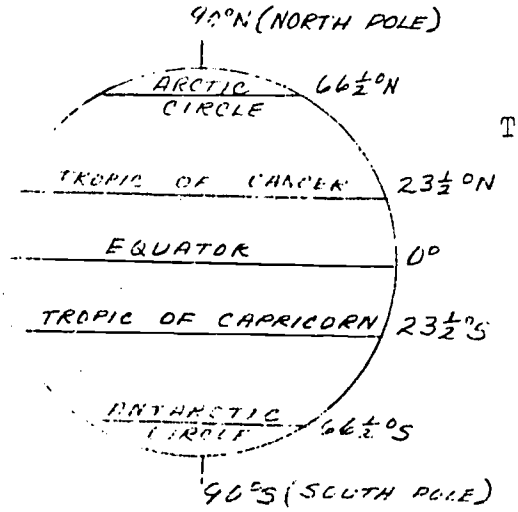


The $23\frac{1}{2}^{\circ}$N parallel is called the Tropic of Cancer. The $23\frac{1}{2}^{\circ}$S parallel is called the Tropic of Capricorn.

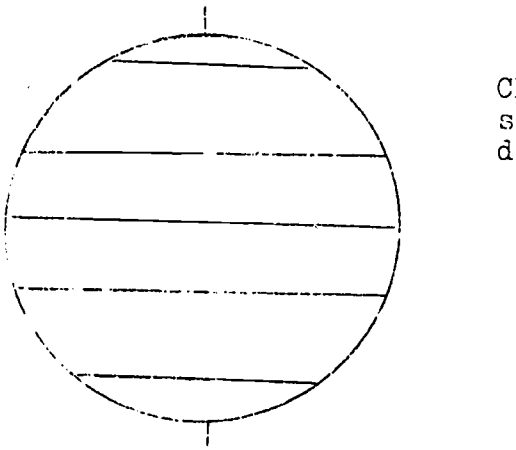


The 90°N parallel is called the North Pole. The 90°S parallel is called the South Pole.

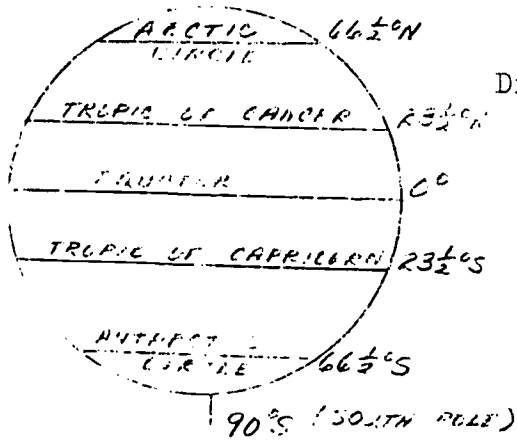
14



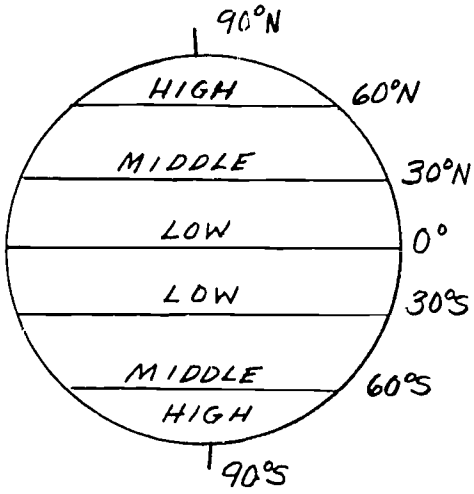
The drawing is now complete.



Check to see if you know the special parallels and their degree locations.



Did you get them all correct?



We refer to parts of the world as being located in high, middle, or low latitudes. These broad belts are shown in the drawing to your left. The low latitudes extend to _____ degrees on each side of the equator.

30°

Refer to the above drawing. The high latitudes are those more than_____ degrees from the equator.

60°

The middle latitudes extend from ____° to ____° on either side of the equator.

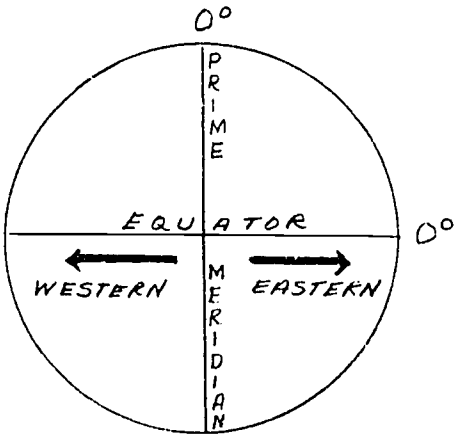
30° to 60°

A degree of latitude is equal to approximately 70 miles. 1°N or S of the equator is 70 miles. 10°N is 10 x 70 miles or 700 miles north of the equator. The latitude of Porto Alegre, Brazil, is 30°S of the equator. This is equal to ____miles south of the equator.

30 x 70=2100 miles

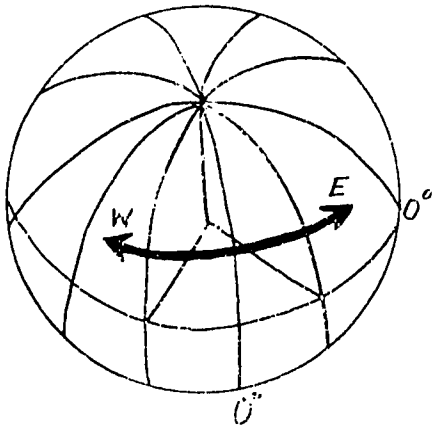
The latitude of Bangor, Maine, is 45°N. This is equal to _____miles north of the equator.

45 x 70 = 3150 miles



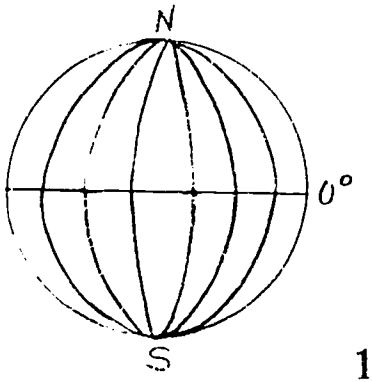
The globe is divided into hemispheres by other lines, the Prime Meridian (0°) and 180°. From the Prime Meridian (0°) longitudes are measured east and west to 180°. The longitudes of ____ and ____ divide the globe into the eastern and western hemispheres.

0° and 180°



To measure distances east and west of the Prime Meridian, we use lines called meridians or longitude. A meridian is a line along which the high sun occurs at some time daily. Distances east and west are measured by lines called _____ or longitude.

meridians



Meridians or _____ extend from pole to pole.

17

longitude

Meridians are not parallel to each other. In the above drawing we see that they come to a point at the _____.

poles

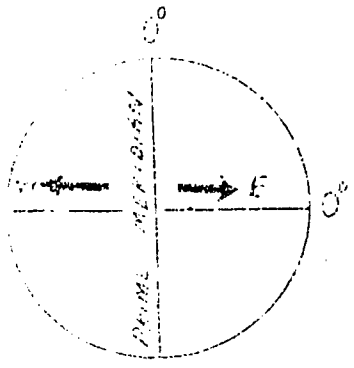
To find distance east and west on the globe, it was necessary to have a starting point for the meridians of longitude. Ken chose one meridian and called it the Prime Meridian (0°). The meridian from which we begin measuring longitude is the _____ _____.

Prime Meridian

The Prime Meridian is the starting point for measuring _____.

Longitude

Longitude is measured east and west of the _____ _____.



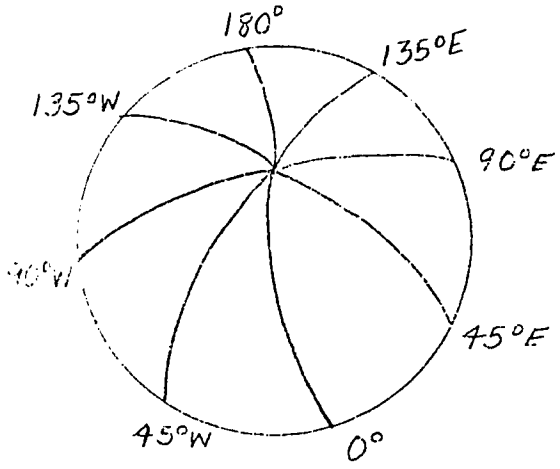
Prime Meridian

Longitude, like latitude, is measured in degrees. Longitude is measured in _____.

18

degrees

On the drawing to your left, note that we number each hemisphere from 0° to 180°.



In talking or writing about longitude or meridians make certain that you indicate the direction you are traveling from the Prime Meridian. Longitude is measured_____ and _____ from the Prime Meridian. Each degree of longitude will be followed by an E (for East longitude) or W (for West longitude).

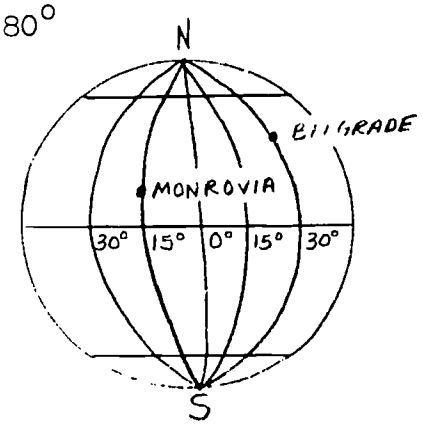
east and west

Meridians indicate how far east or west a place is from the _____ _____.

Prime Meridian

You can see this on a map as you move east or west from the Prime Meridian, the numbers get larger until you reach 180°.

180°

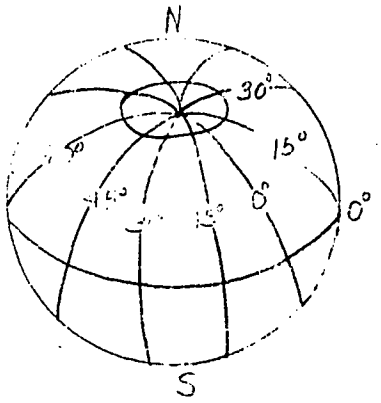


Belgrade is _____ of the Prime Meridian.

east

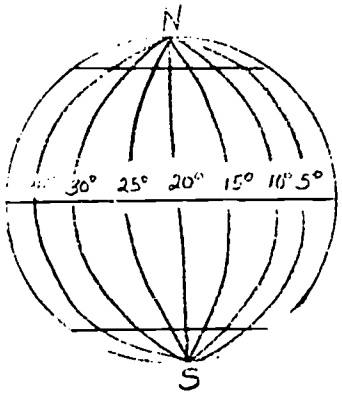
Monrovia is _____ of the Prime Meridian.

west



The numbers are getting larger as you go left. You are moving away from the Prime Meridian (0°) toward the west. The numbers are west longitude. They are _____ (direction) of the Prime Meridian.

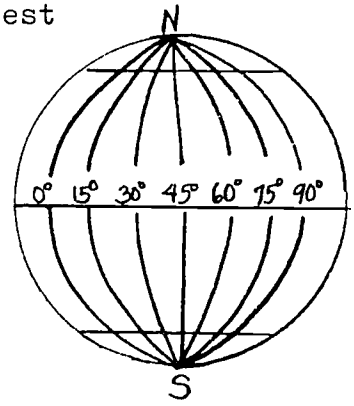
west



Try this! Are the meridians shown in east or west longitude?

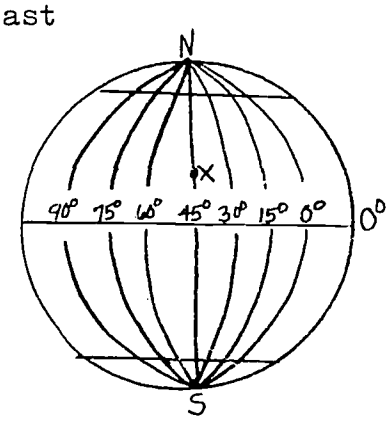
Another! Are the meridians shown in east or west longitude?

west



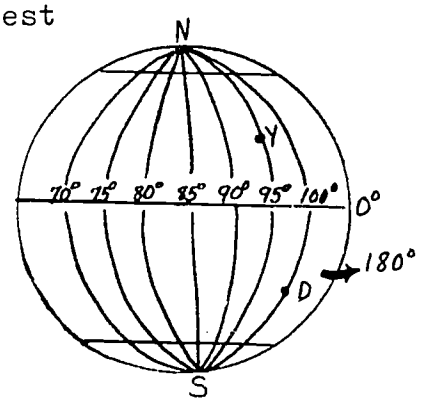
Is X east or west of the Prime Meridian?

east



Is D east or west of Y?

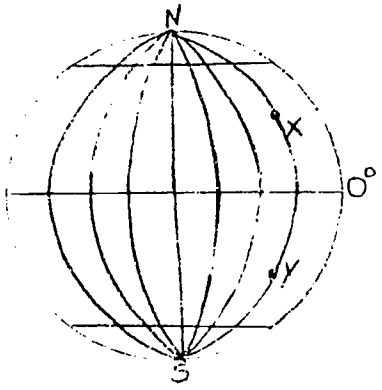
west



east

Meridians also show true north-south direction. Each meridian connects the North Pole and the _____ _____.

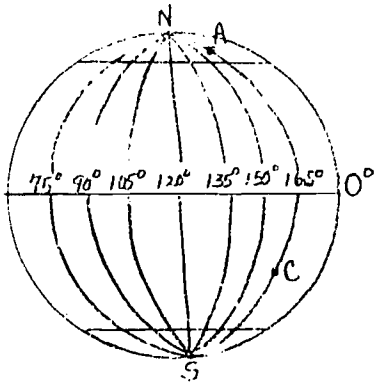
South Pole



Every point on a meridian is directly north or _____ of any other point on the meridian.

south

Meridians always show north-south direction.

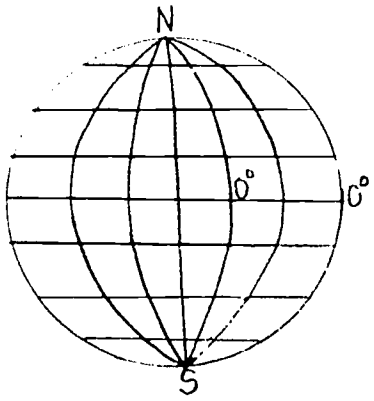


A is _____ of C.

C is _____ of A.

north

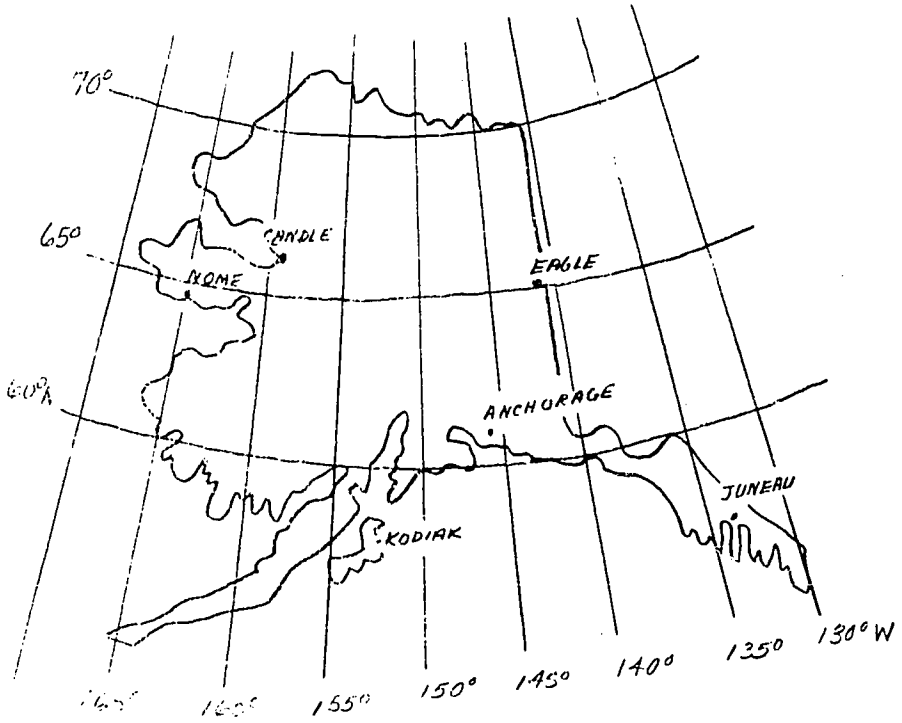
south



The pattern formed by the parallels and meridians on a globe or map is called a grid. The grid is useful in finding direction and locations. The combination of parallels and meridians is called a _____.

grid

By using the grid, we can find the location of towns, cities, states, and countries.



23

On the map above, find the city whose latitude is approximately $64\frac{1}{2}^{o}$N and longitude 165^{o}W. The city is _____.

Nome

On the map above, find the city located at approximately 61^{o}N and 146^{o}W. The city is _____.

Anchorage

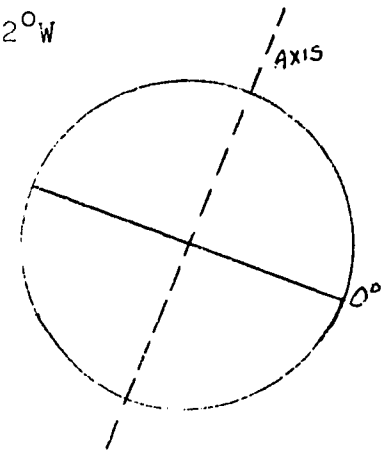
In speaking or writing about the location of any town, city, or state, latitude is always given first. Then the longitude is given. On the map above, we would say that the latitude of Eagle is _____.

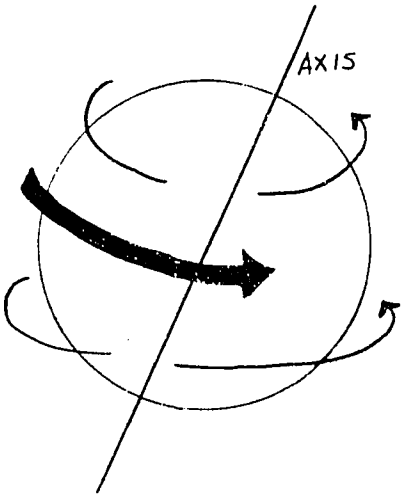
65^{o}N

After the latitude is given, we can then give the longitude of Eagle as _____.

142^{o}W

The earth rotates (turns) on its axis. The earth's axis is tilted so that it points to the North Star or $23\frac{1}{2}^{o}$ from the perpendicular to the plane of the orbit.



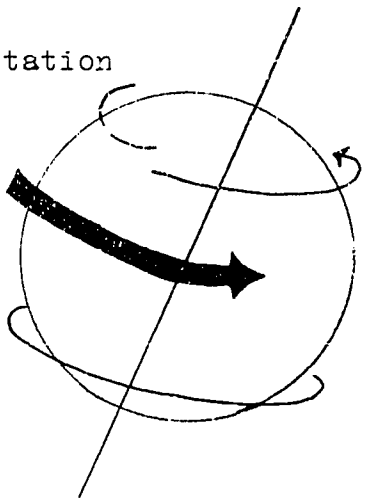


A rotation is one complete turn of the earth on its axis. The length of time required to complete one rotation is called a day. The earth completes a rotation once every_____.

day or 24 hours

The rotation of the earth causes daylight and darkness. Half of the earth is having day and half is having night at all times. Daylight and darkness are caused by the _____ of the earth.

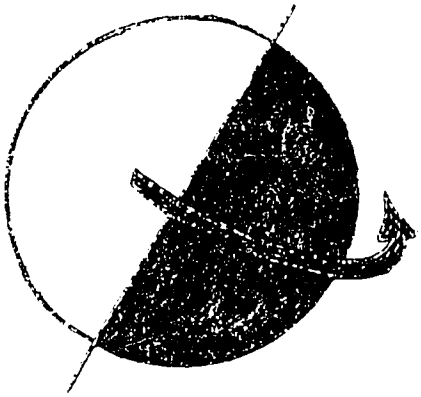
rotation



Rotation of the earth causes daylight and darkness as the earth rotates from west to east. The direction the earth rotates is from _____ to _____.

west to east

The fact that rotation of the earth causes daylight and darkness can be explained by looking at the drawing to your left.



It is daylight on the side facing the light, while it is _____ on the shadow side.

night

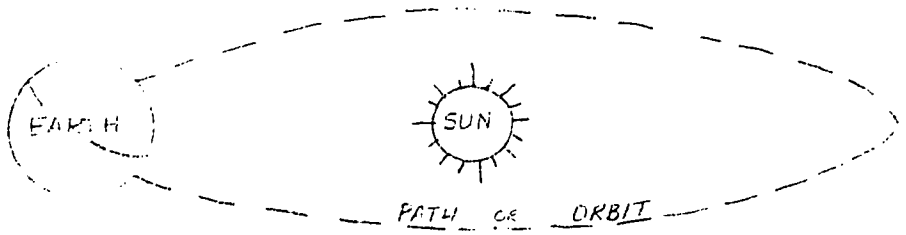
As the earth rotates toward the east, the area of the earth that was in daylight will move into darkness. Thus, this part of the earth will have gone from day to _____.

night

Revolution means that the earth moves around the sun. The earth moves along an elliptical orbit around the sun. This movement is called _____.

revolution

The earth follows an elliptical _____ around the sun.



orbit

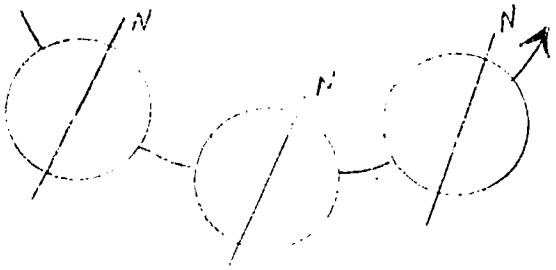
It takes the earth one year to make one revolution around the _____.

sun

As the earth revolves around the sun, it is also rotating on its axis each day. Thus while the earth makes one revolution around the sun, it has turned on its axis 365¼ times. The period of time that it takes for one revolution is a _____.

year or 365¼ days

Seasons are caused by the revolution of the earth about the sun. Also, the earth's axis is tilted at the same angle and in the same direction as the earth follows in its orbit. The axis always points to the north star.



As the earth revolves around the sun, the axis points in the same direction. The northern end of the axis points toward the _____ star.

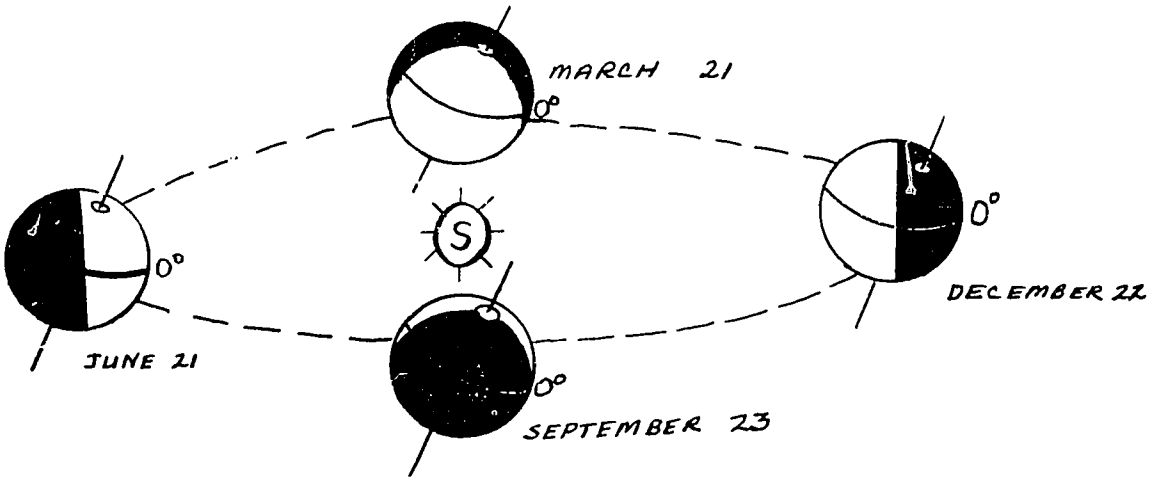
North

The tilting of the earth's axis always in the same direction is called parallelism of the earth's axis.

Parallelism of the earth's axis means that the _____ points in the same direction at all times.

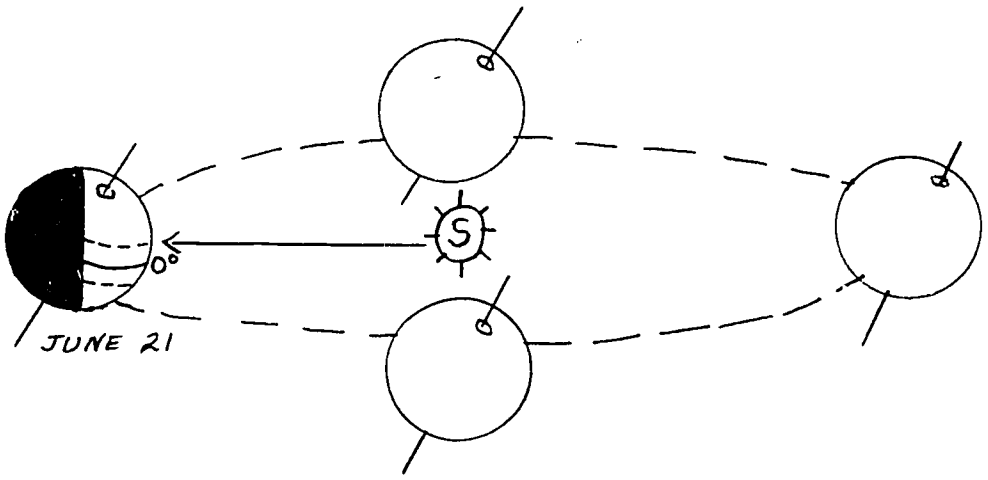
axis

Parallelism of the earth's axis causes the sun to shine on different parts of the earth (at different angles) throughout the year. Look below to see the diagram.



28

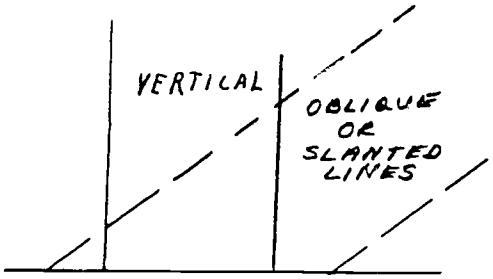
On June 21, the vertical rays of the sun reach the northern limit of their migration ($23\frac{1}{2}^{o}$N). The midday sun is directly overhead at noon at the Tropic of Cancer and there are no shadows. The vertical rays of the sun reach the _____ _____ on June 21.



Tropic of Cancer or $23\frac{1}{2}^{o}$N

In June, the northern hemisphere is tilted $23\frac{1}{2}^{o}$ towards the sun. On June 21, the vertical rays of the sun strike the earth's surface at the Tropic of Cancer or _____.

$23\frac{1}{2}^{o}$N



The vertical rays of the sun are the warmest. They concentrate their heat on a smaller area. As the rays become vertical or high in the sky in the northern hemisphere, we have summer. Summer is the _____ season.

warmest

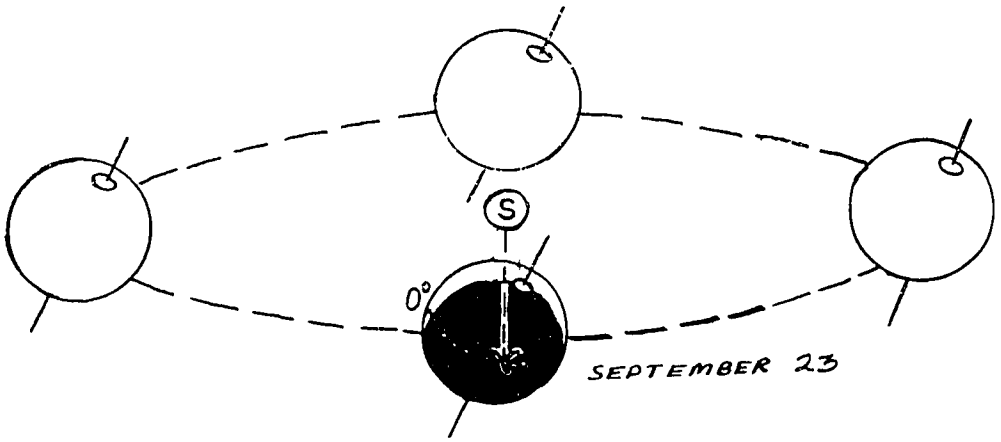
On June 21, the beginning of summer in the northern hemisphere, not only is the noon day sun the highest in the sky but this day also has the most hours of daylight (summer solstice). In the northern hemisphere, the summer solstice occurs on _____.

June 21

June 21 is the longest day of the year in the northern hemisphere. As the earth continues to revolve around the sun, the days following June 21 will become _____ in terms of daylight.

shorter

As the earth continues to revolve around the sun, the vertical rays of the sun are no longer at the Tropic of Cancer. The vertical rays are over latitudes nearer the equator each day. By September 23 the vertical rays of the sun will be over the equator. The vertical rays of the sun reach the _____ on September 23.

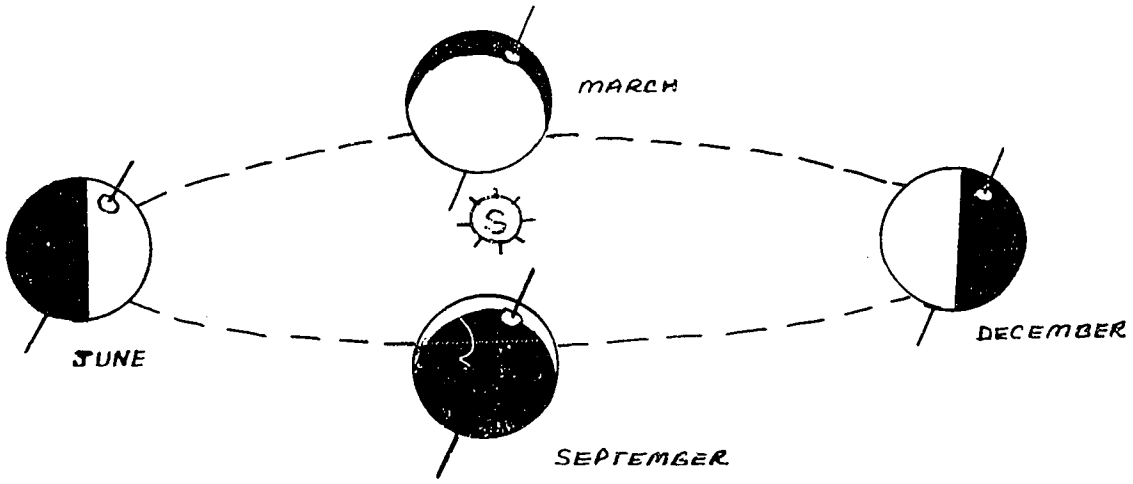


equator

On this day, September 23, the sun is seen directly overhead at noon at the equator. It is the only place where the noon sun can be seen directly _____ on September 23.

overhead

On September 23, we have the autumnal equinox in the Northern Hemisphere. The earth is halfway between the June and December positions in its orbit around the sun. At this time neither pole is titled toward the sun more than the other. The vertical rays are directly overhead at the _____.



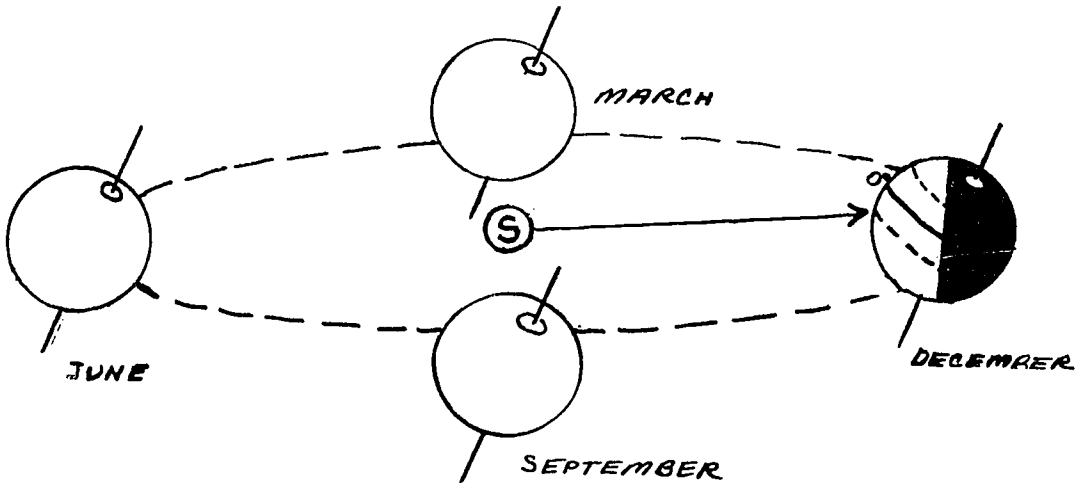
equator

Equinox means equal day and night. On this day, all places on the earth, have daylight for 12 hours and darkness for 12 hours. Thus on September 23 everyone has _____ day and night.

equal

As the earth continues in its orbit around the sun, it is approaching its December position.

In December, the Northern Hemisphere is tilted $23\frac{1}{2}^{o}$ away from the sun. On December 22, the vertical rays of the sun strike the earth's surface at the Tropic of Capricorn or _____ degrees south of the equator.



32

$23\frac{1}{2}^{o}S$

On December 22 the migration of the vertical rays of the sun reach their southern limit, the Tropic of Capricorn. While the Southern Hemisphere is receiving the high sun, we in the Northern Hemisphere are receiving more slanted or oblique rays. The vertical rays of the sun reach the _____ _____ on December 22.

Tropic of Capricorn or $23\frac{1}{2}^{o}S$

On December 22, in the Northern Hemisphere, the midday sun is low in the sky and the rays of the noonday sun for the Northern Hemisphere are at the greatest slant. We are now having our coldest season in the Northern Hemisphere or _____.

winter

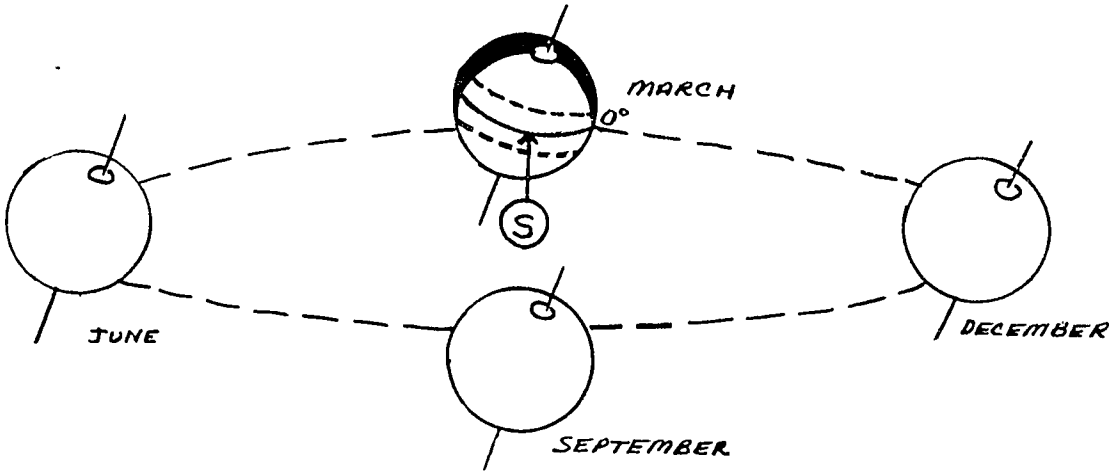
On December 22, the beginning of winter in the Northern Hemisphere, not only is the noon sun lowest in the sky but this day also has the shortest period of daylight (winter solstice). In the Northern Hemisphere, the winter solstice occurs on _____.

December 22

December 22 is the shortest day of the year in the Northern Hemisphere in terms of daylight hours. As the earth continues to revolve around the sun, the days following December 22 will be _____ in terms of daylight hours.

longer

As the earth continues to revolve around the sun, the vertical rays of the sun are no longer on the Tropic of Capricorn. The vertical rays are over latitudes nearer the equator each day. By March 21, the vertical rays of the sun are over the equator. The vertical rays of the sun reach the _____ on March 21.



equator

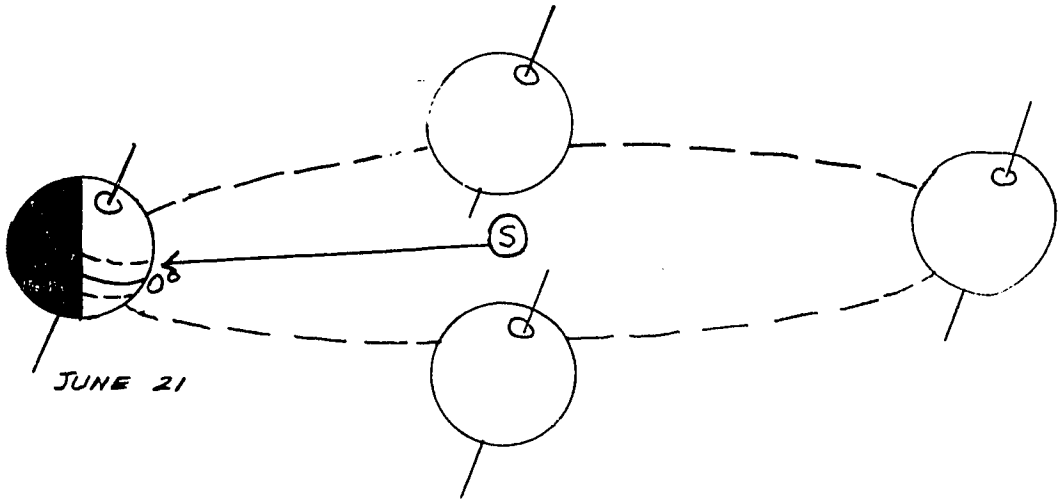
At the equator on March 21, the sun again is seen directly overhead at noon. The _____ is the only place where the sun can be seen directly overhead on March 21 and September 23.

equator	On March 21, we have the vernal (spring) equinox in the Northern Hemisphere. Again the earth is halfway between the June and December positions in its orbit around the sun. The vertical rays of the sun are over the _____ on this day.
equator	We know that equinox means _____ day and night. We have an equinox once again on March 21.
equal	March 21 is the beginning of _____ in the Northern Hemisphere.
spring	As the earth continues in its orbit around the sun, we find that the earth is approaching its June position again. On June 21 we find that the Northern Hemisphere is having _____ (season).
summer	You have learned about seasons, vertical and slanted rays of the sun and the position of the earth in relation to the sun for the Northern Hemisphere. The seasons for the Southern Hemisphere are opposite to those of the Northern Hemisphere. If we are having winter in the Northern Hemisphere, they will be having _____ in the Southern Hemisphere.

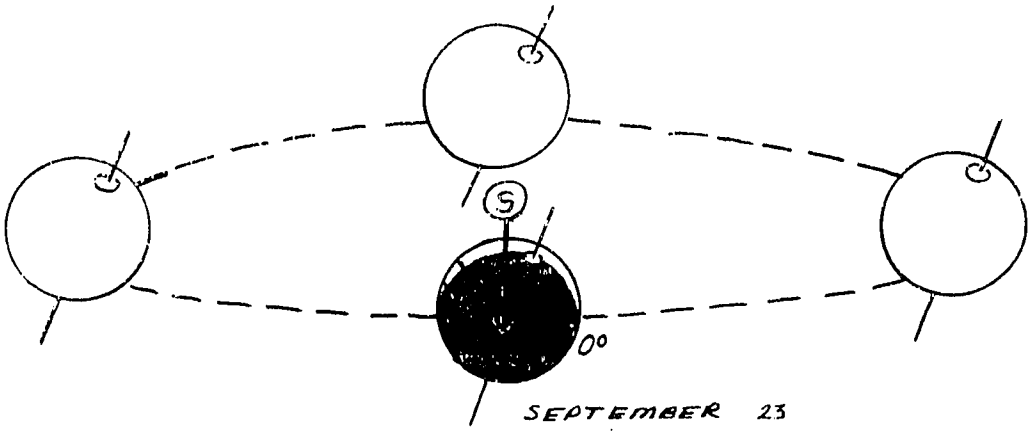
summer

Since you already know about the seasons of the Northern Hemisphere, see if you can figure out the seasons of the Southern Hemisphere from the abbreviated story below.

On June 21, the Southern Hemisphere is tilted $23\frac{1}{2}^{o}$ away from the sun. On this day the vertical rays of the sun are over the Tropic of Cancer or $23\frac{1}{2}^{o}$N. The vertical rays of the sun are over the _____ Hemisphere.



Northern	On June 21, the migration of the vertical rays of the sun reach their northern limit, the Tropic of Cancer. The Northern Hemisphere is receiving the vertical rays of the high sun and enjoying its warmest season or _____.
summer	On June 21 in the Southern Hemisphere, the midday sun is low in the sky and the rays of the sun for the Southern Hemisphere are at the greatest slant. This is the beginning of the coldest season or _____.
winter	On June 21, the beginning of winter in the Southern Hemisphere, not only is the noon sun lowest in the sky but this day also has the shortest period of daylight (winter solstice). In the Southern Hemisphere, the winter solstice occurs on _____ (date).
June 21	On September 23, the vertical rays of the sun have reached the equator. The noonday sun can be seen directly overhead. The vertical rays of the sun reach the _____ on September 23.



equator

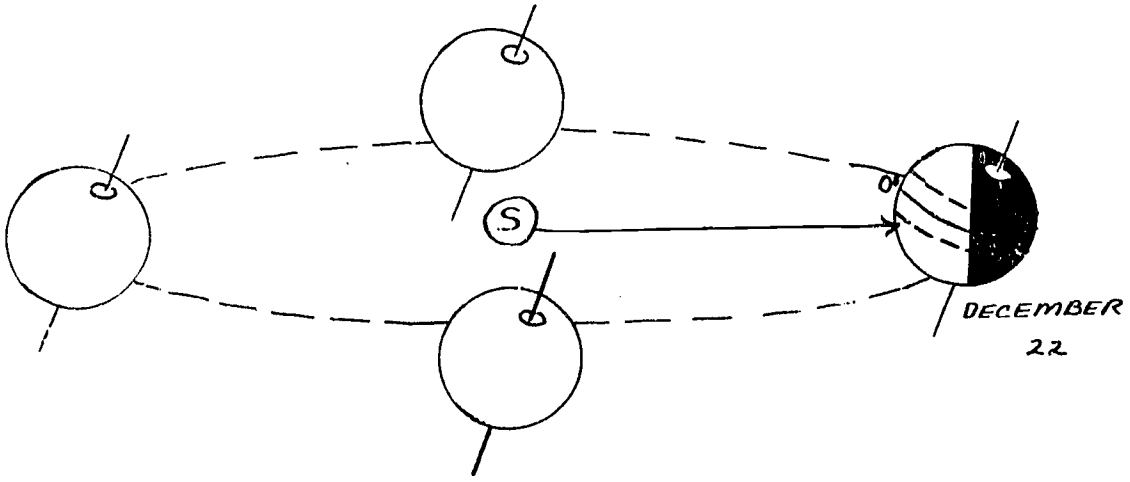
On September 23, there is an equinox. You recall that equinox means _____ _____.

equal daylight and equal darkness

In the Southern Hemisphere September 23 is known as the Vernal Equinox (or the beginning of spring). However, we know that on this day in the Northern Hemisphere we are having the autumnal equinox or the beginning of _____.

autumn or fall

In December, the Southern Hemisphere is tilted $23\frac{1}{2}^{o}$ toward the sun. On December 22, the vertical rays of the sun are over the Tropic of Capricorn or _____ (degrees).



$23\frac{1}{2}^{o}S$

On December 22, the migration of the vertical rays of the sun reach their southern limit, the Tropic of Capricorn. The Southern Hemisphere is receiving the vertical rays of the sun and enjoying its warmest season or _____.

summer

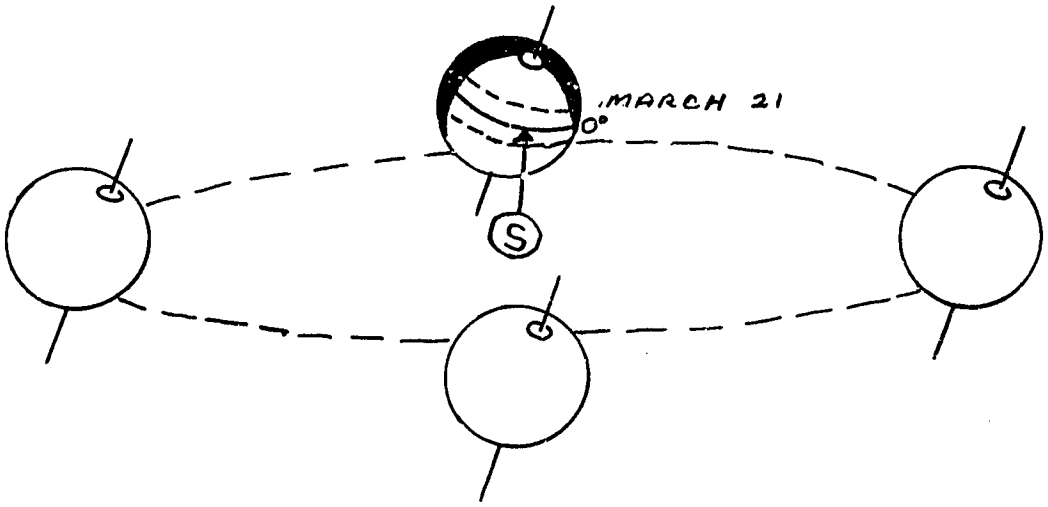
On December 22, the beginning of summer in the Southern Hemisphere, not only is the noon sun highest in the sky but this day also has the most hours of daylight (summer solstice). In the Southern Hemisphere, the summer solstice occurs on _____ (date).

December 22

In December the Northern Hemisphere is receiving slanted rays of the sun. This is the beginning of their coldest season or _____.

winter

On March 21, the vertical rays of the sun have reached the equator again. The noonday sun can be seen directly overhead. The vertical rays of the sun reach the _____ on March 21.



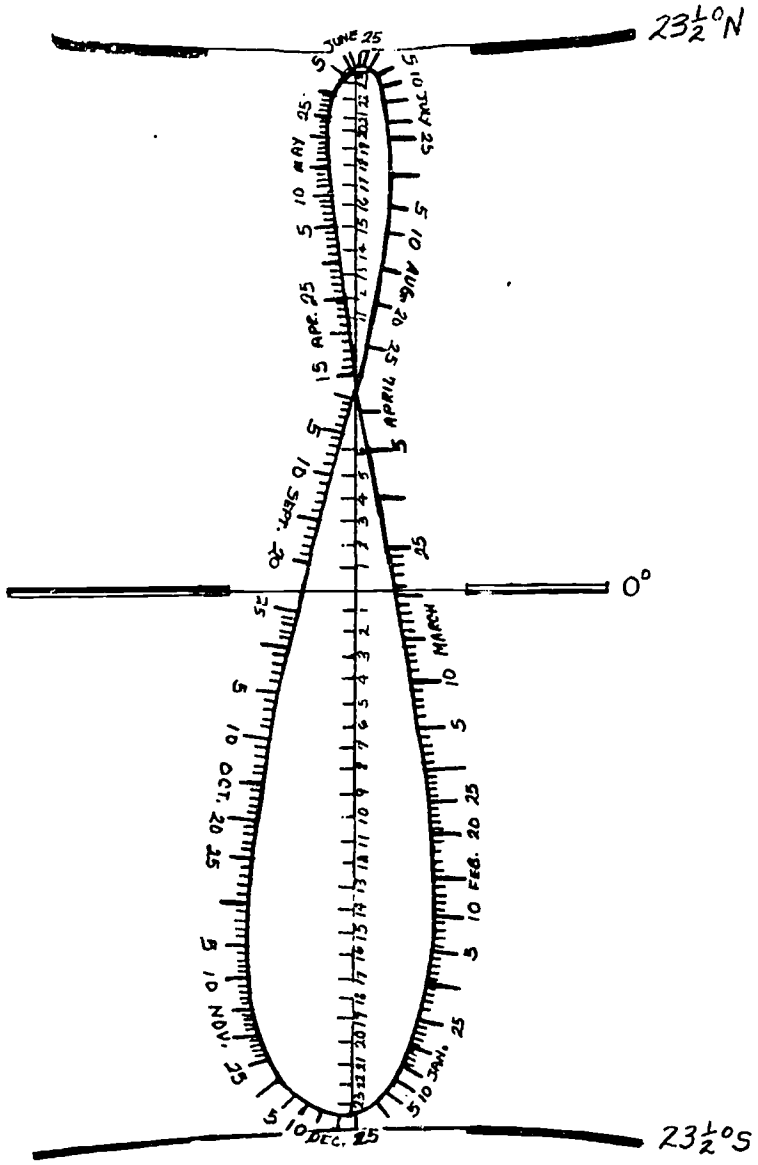
equator

On this day, March 21, an equinox occurs. Equinox means _____.

equal daylight and equal darkness

In the Southern Hemisphere, March 21 is known as the autumnal equinox (or the beginning of _____).

40


23½°N
0°
23½°S
JUNE 25
MAY 25
APRIL 25
MARCH
FEB. 20 25
JAN.
DEC. 25
NOV. 25
OCT. 20 25
SEPT. 25
AUG. 25
JULY 25
10
15
20

41

autumn or fall	On this same date (March 21) the Northern Hemisphere is having the vernal equinox or the beginning of _____.
spring	An analemma extends from the Tropic of Cancer, $23\frac{1}{2}^{o}$N to the Tropic of Capricorn, $23\frac{1}{2}^{o}$S. An analemma is used on a globe to tell at what latitude the sun is seen directly overhead at noon. You can find the location of where the sun can be seen directly overhead at noon by using an _____.
analemma	See drawing.
	On the analemma find the equator. Find the degrees north and south of the equator to $23\frac{1}{2}^{o}$N and $23\frac{1}{2}^{o}$S. Find the months and the days of the months along the edge of the analemma.
	The sun is directly overhead on September 23 at _____^{o}.
0^{o} or equator	The sun is directly overhead on October 21 at _____^{o}.
11^{o}S	The sun is directly overhead on November 21 at _____^{o}.

$20^{\circ}S$	The sun is directly overhead on December 22 at _____$^{\circ}$.
$23\frac{1}{2}^{\circ}S$ Tropic of Capricorn	We are having _____ in the Northern Hemisphere on December 22.
winter	The Northern Hemisphere is tipped _____ from the sun at this time.
away	The sun is directly overhead on January 21 at _____$^{\circ}$.
$20^{\circ}S$	The sun is directly overhead on February 21 at _____$^{\circ}$.
$11^{\circ}S$	The sun is directly overhead on March 21 at _____$^{\circ}$.
0° or equator	March 21 is the beginning of _____ in the Northern Hemisphere and the beginning of _____ in the Southern Hemisphere.
spring, autumn	The sun is directly overhead on April 21 at _____$^{\circ}$.

43

11°N	The sun is directly overhead on May 21 at _____°.
20°N	The sun is directly overhead on June 21 at _____°.
23½°N or Tropic of Cancer	On June 21, the Northern Hemisphere is tipped _____ the sun and this is the beginning of _____ for us.
toward; summer	The sun is directly overhead on July 21 at _____°.
20°N	The sun is directly overhead on August 21 at _____°.
12°N	If you have mastered the material above, you now understand the seasons better in regards to the location of the direct rays of the sun.

The program, Time Around the World, has been designed to teach the concept of longitude and time. Emphasis has been placed on:

1. Using the globe as a model for the earth.
2. Orienting the globe with true direction so the student can use the globe to identify directions in the real environment.
3. Rotation of the globe from west to east in relation to time around the world.
4. Longitude and time through one rotation of the globe on its axis each day of twenty-four hours.

TIME AROUND THE WORLD

Time is related to longitude. There are 360° of longitude on the earth's sphere or 180° in each direction from the Prime Meridian. Each day the earth rotates through the 360° of longitude in a 24-hour period. Rotation of the earth occurs once every _____.

day or 24 hours

The earth rotates through 360° of longitude in a 24-hour period. In one hour, the earth rotates through 15° or $24\overline{)360^{\circ}}$. To rotate through 15° of longitude, it takes the earth _____ hour (s) of time.

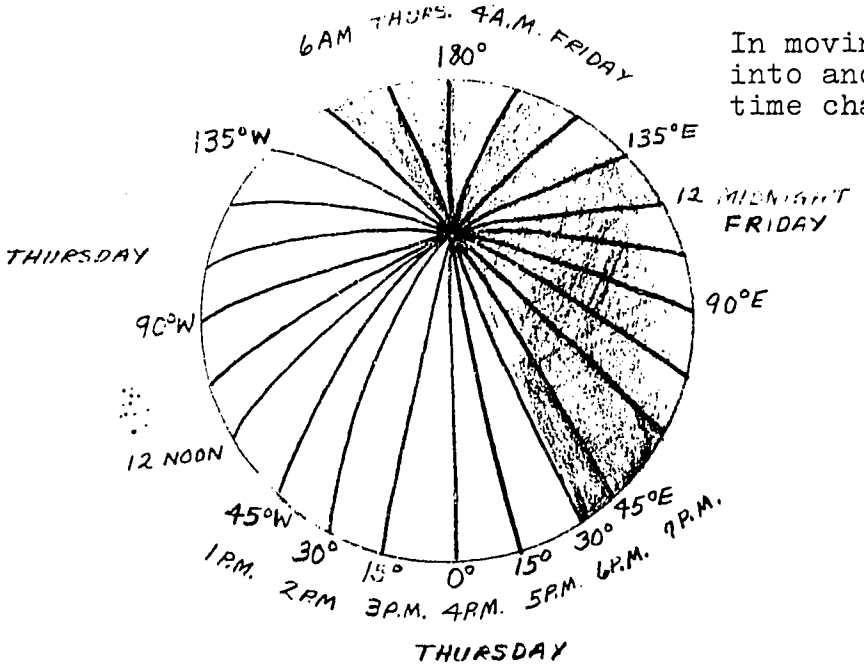
one or 1

We find every 15° of longitude is equal to _____ hour (s) of time.

one or 1

The entire earth is divided into 24 blocks of longitude called time zones. There is one time zone for each 15° of longitude. Each time zone in the world is _____ apart.

15°



In moving from one time zone into another next to it, the time changes by _____ hour (s).

one or 1

The earth rotates from West to East. The sun rises first for places in the East. Places East always _____ the sun rise before places West.

have

In the United States, our east coast receives the sun rise before our _____ coast does.

west

Since the East receives the sunlight before the West, the East will always have later time of day than the West. The East has a _____ time than the West.

later

It would be best for man to use a 24-hour clock, but since he uses a 12-hour clock, he must designate which 12 hour period he is referring to. A.M. means ante meridian or before the noon sun reaches a particular meridian.

For example,at a particular place, 11:00 o'clock in the morning would be 11:00 _____ _____ o'clock.

A.M.

From 12:00 midnight until 12:00 noon each day is A.M. Therefore, any given time between midnight and noon is followed by the abbreviation, _____ _____.

A.M.

P.M. means post meridian or after the noon sun is past the particular meridian. For example, 9:00 o'clock in the evening would be 9:00 _____ _____ o'clock.

P.M.

From 12:00 noon until 12:00 midnight each day is considered P.M. Any stated time between noon and midnight would be followed by the abbreviation _____ _____.

P.M.

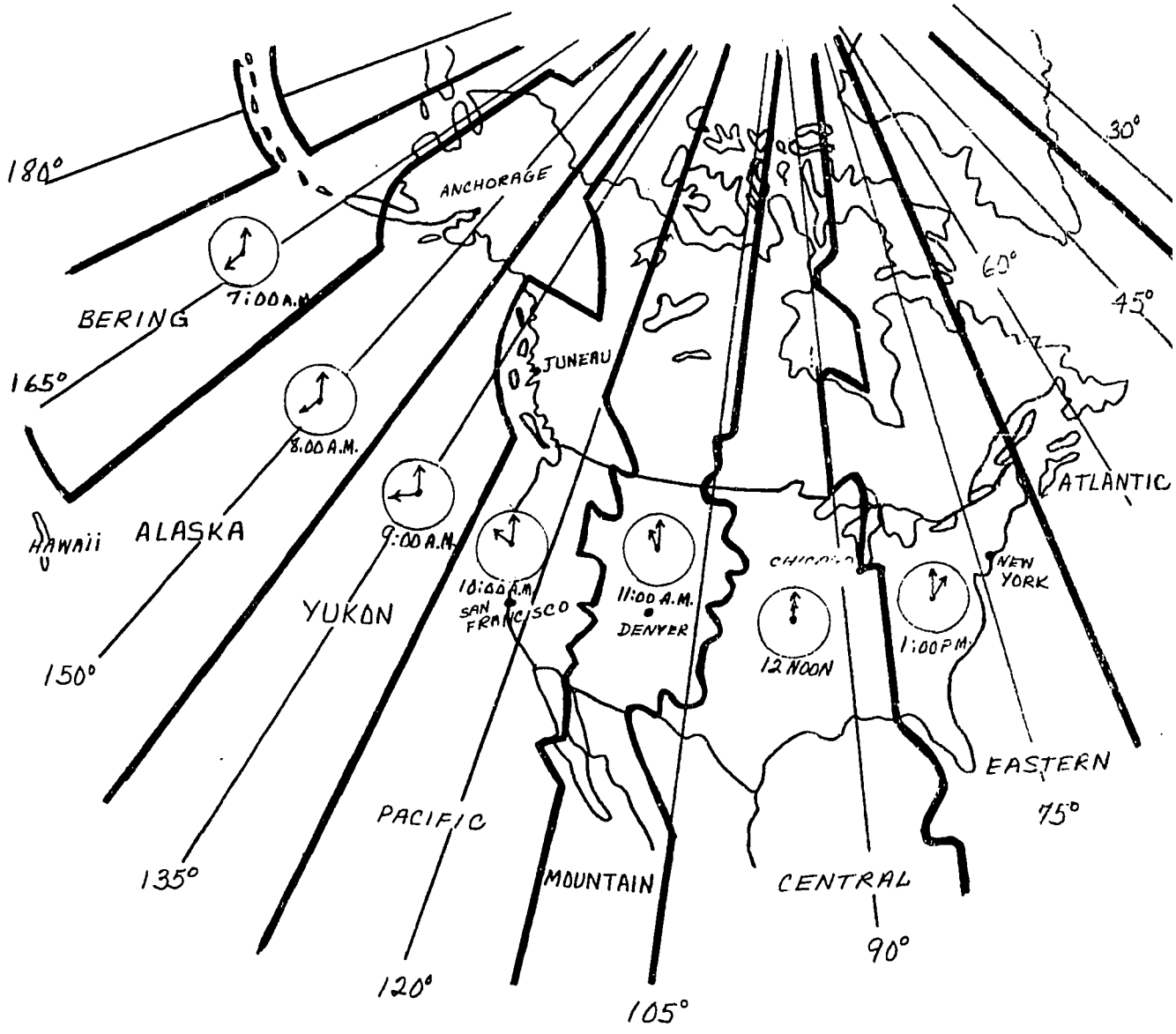
Review:
When the earth rotates through 15° of longitude, it has taken _____ hour (s) of time.

one or 1

The East has _____ time than the West.

later

A.M. refers to _____.


180°
ANCHORAGE
7:00 A.M.
BERING
165°
8:00 A.M.
JUNEAU
9:00 A.M.
Hawaii
ALASKA
150°
YUKON
10:00 A.M.
SAN FRANCISCO
11:00 A.M.
DENVER
12 NOON
1:00 P.M.
NEW YORK
ATLANTIC
30°
60°
45°
135°
PACIFIC
MOUNTAIN
CENTRAL
EASTERN
75°
90°
120°
105°

morning or before the sun is on the meridian

evening or after the sun is on the meridian

A.M. or P.M.

(Check the Time Zone Map)

15°

later

P.M. refers to _____.

Whenever any time is given, it should be followed by the abbreviation ____ or ____.

Refer to the drawing of the time zones.

In the United States, there are 6 time zones. Each time zone has been given a specific name. We live in the _____ Time Zone.

The boundaries of the time zones are approximately 15° apart. Each time zone contains _____° of longitude.

If you travel west across the United States, you will have to set your watch back one hour at each new time zone. Thus, eastern United States has _____ time than western United States.

Work the following problems using the Map of the Time Zones.

A traveler will cross _____ time zone boundaries on a trip from New York to San Francisco.

three or 3	As a traveler crosses the time zone boundaries from New York to San Francisco, he will set his watch ____ at each time zone boundary.
back	In traveling from Denver to Dallas, a traveler will set his watch _____.
ahead	Why does a traveler turn his watch ahead in traveling from Denver to Dallas?
Dallas is east of Denver and thus we will find that Dallas has later time.	When it is 7:00 A.M. Mountain Time, the time in the Pacific Time Zone is _____ o'clock.
6:00A.M. Did you remember to put the A.M. after the time?	When it is 10:00 A.M. Central Time, the time in the Alaskan Time Zone is _____ o'clock.
6:00 A.M.	When it is 5:00 P.M. Pacific Time, the time in the Eastern Time Zone is _____ o'clock.
8:00 P.M.	A baseball game is broadcast in New York beginning at 2:00 P.M. In the Yukon Time Zone the baseball game begins at _____ o'clock.
10:00 A.M.	In the Pacific Time Zone the baseball game begins at ____ o'clock.

11:00 A.M.

A new day begins immediately after 12:00 midnight. Thus if it were 12:00 midnight Monday, the next seconds after midnight we have a new day, Tuesday, A new day begins after _____.

midnight

When it is 12:00 midnight Tuesday, Mountain Time, the time in the Central Time Zone is _____.

1:00 A.M. Wednesday. Did you remember that a new day began?

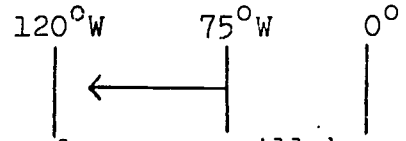
When it is 12:00 midnight Saturday, Central Time, the time in the Alaskan Time Zone is _____ _____.

8:00 P.M. Saturday. Remember the Alaskan Time Zone is west of the Central Time Zone and you must count back 4 hours.

That was easy. Now let's do some other problems that require a little more work. Below there is a step by step solution for one of the problems.

It is 10:00 P.M. at Philadelphia ($75^{\circ}W$). It is _____ o'clock in San Francisco ($120^{\circ}W$).

1. The direction you are traveling is _____.



Therefore, you will have _____ time.

west

earlier

2. There are _____ degrees difference between the two places.

$$\begin{array}{r} 120^{\circ} \\ -75^{\circ} \\ \hline \end{array}$$

45°

3. This is equivalent to ____ hours.

$15^{\circ} \overline{)\ 45^{\circ}}$

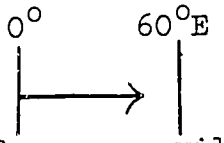
3

4. It is 3 hours earlier, therefore, it is _____ o'clock in San Francisco.

7:00 P.M. Remember the time must be followed by A.M. or P.M.

It is 12:00 noon in London (0°). It is ____ o'clock at Meshed, Iran. (60°E).

1. The direction you are traveling is _____.



east

Therefore, you will have _____ time.

later

2. There are _____ degrees difference between the two places.

$$\begin{array}{r} 60^{\circ} \\ -0^{\circ} \\ \hline \end{array}$$

53

60°

3. This is equivalent to ____ hours.

$15^{\circ})\ 60^{\circ}$

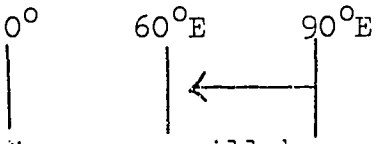
4

4. It is 4 hours later at Meshed, therefore it is _____ o'clock.

4:00 P.M.

It is 12:00 midnight Monday at Le Bear (90°E). It is _____ o'clock at Meshed (60°E).

1. The direction you are traveling is _____.



west

Therefore, you will have _____ time.

earlier

2. There are _____ degrees difference between the two places.

$$\begin{array}{r} 90^{\circ} \\ -60^{\circ} \\ \hline \end{array}$$

30°

3. This is equivalent to ____ hours.

2

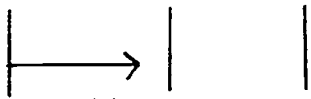
4. It is 2 hours earlier at Meshed, therefore, it is _____ o'clock_____.

10:00 P.M. Monday

Let's do some problems that involve both East and West longitude. It will be done the same way but in two parts.

It is 5:00 A.M. at 60°W. What time is it at 45°E? Work to the Prime Meridian first and then work from the Prime Meridian to 45°E.

1. 60°W 0° 45°E



The direction you are traveling is _____.

east

Therefore, you will have _____ time.

later

2. 60°
-0°

There are _____$^{\circ}$ difference between the two places.

60°

3. 15°) 60°

This is equal to _____ hours.

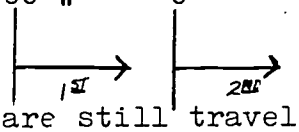
4

4. It is 4 hours later at the Prime Meridian or _____ o'clock.

9:00 A.M.

Now work from the Prime Meridian to 45°E. It is 9:00 A.M. at the Prime Meridian, what time is it at 45°E?

1. $60^{\circ}W$ 0° $45^{\circ}E$



You are still traveling _____.

east

2. 45°
-0°

There are ____° difference between the two places.

45°

3. $15^{\circ}\overline{)\ 45^{\circ}}$

This is equal to _____ hours.

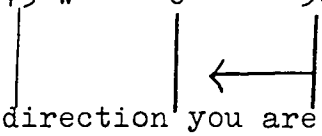
3

4. It is 3 hours later at 45°E or _____.

12:00 noon

It is 2:00 P.M. in Berlin (30°E). What time is it in Pittsburgh (75°W)? Work to the Prime Meridian first.

1. 75°W 0° 30°E



The direction you are traveling is _____.

west

2. 30°
-0°

There are _____$^{\circ}$ difference between the two places.

30°

3. $15^{\circ})\overline{\ 30}$

This is equal to _____ hours.

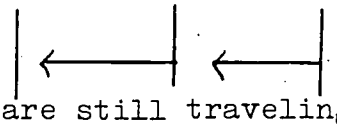
2

4. It is two hours earlier at the Prime Meridian or ____ o'clock.

12:00 noon

Now work from the Prime Meridian to 75°W. It is 12:00 noon on the Prime Meridian. The time in Philadelphia (75°W) is _____ o'clock.

1. $75^{\circ}W$ 0° $30^{\circ}E$



You are still traveling _____.

west

2. 75°
-0°

There are _____$^{\circ}$ difference between the two places.

75°

3. $15^{\circ})\overline{\ 75^{\circ}\ }$

This is equal to _____ hours.

5

4. It is 5 hours earlier in Pittsburgh or _____ o'clock.

Let's try a worksheet now!

7:00 A.M.

Work Sheet

Name _____ Section _____

1. It is 5:00 P.M. in New York City (75°W). What time is it at Denver (105°W)? _____

2. It is 8:00 A.M. at the Prime Meridian. What time would it be at 60°E? _____

3. It is 5:00 P.M. in New York City (75°W). What time is it at 15°W? _____

4. It is 11:00 P.M. (Thursday) in Chicago, Ill. (90°W). What time is it at the Prime Meridian? _____

5. It is 12 midnight (Tuesday) in Greenwich. What time is it at New York City (75°W)? _____

6. The time at 75°E is 4:30 A.M. What time is it at 105°E? _____

7. It is 6:00 A.M. (Friday) at 105°W. What time is it at 165°E? _____

8. It is 2:00 P.M. (Thursday) at 105°E. What time is it 30°W? _____

9. If it is 5:00 P.M. at 45°W, what time is it at 30°E _____?

10. If it is 10:00 A.M. Saturday at Denver (105°W), what time is it at Cairo, Egypt (30°E)? _____

11. It is 8:00 P.M. Sunday in Pittsburgh (75°W). What time is it at Sydney, Australia (150°E)? _____

12. It is 2:30 A.M. (Tuesday). At 15°E, what time is it at 180°E? _____

13. It is 12 noon in Penn Hills, (75°W). What time is it at 180°W? _____

14. It is 12 midnight Monday in Chicago (90°W). What time is it in London, England? _____

15. If it is 9:15 P.M. at 120°E, what time is it at 60°W? _____

59

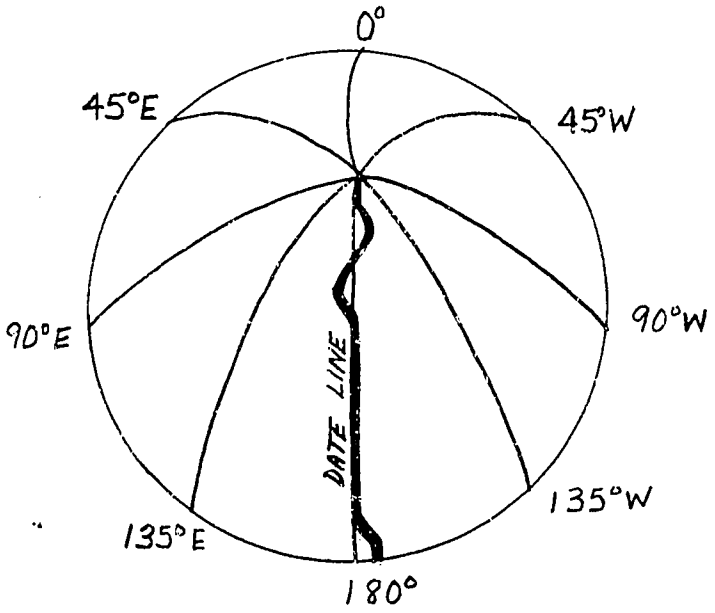
Time doesn't stand still. But if people had no way of allowing for changes in the _____ zones, it would be very confusing. That's why the nations of the world established the International Dateline.

time

The International Dateline follows the 180° meridian except in a few places where it shifts to avoid important bodies of land. The 180° meridian is also known as the _____ _____.

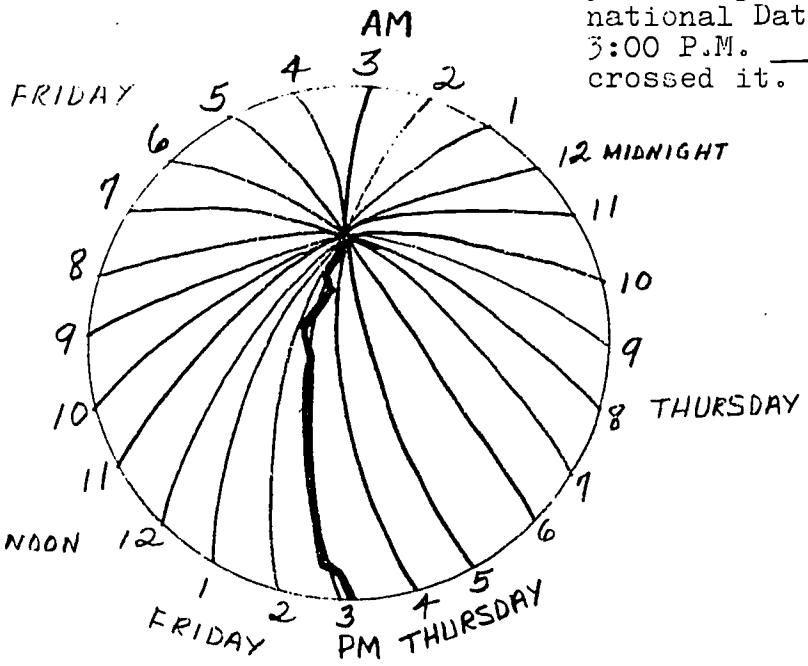
International Dateline

This sketch shows that the International Dateline generally follows the ____° meridian.



180°

When you sail westward across the International Dateline, the captain of your ship might say, "Well, folks, tear the date off your calendar. We've just gone into tomorrow." If it is 3:00 P.M. Thursday when your ship reaches the International Dateline, it will be 3:00 P.M. _____ after you have crossed it.



Friday

If you are traveling eastward across the International Dateline from Japan to the United States, you _____ a day on the calendar. You slip right into yesterday.

repeat